APPENDIX A

WATER AND WASTEWATER FEASIBILITY STUDY

WATER AND WASTEWATER FEASIBILTY STUDY

for

MENOMINEE KENOSHA GAMING AUTHORITY
KENESAH GAMING DEVELOPMENT, LLC

MENOMINEE CASINO-HOTEL
EXISTING DAIRYLAND GREYHOUND PARK
City of Kenosha, Kenosha County, WI

March 30th, 2005

PREPARED FOR:

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Abbreviations Used in Report:

gpd = gallons per day
gpm = gallons per minute
gal = gallons
ac. = acres
MGD = millions gallons per day
L.F. = lineal feet

Section 1 – Introduction

1.1 Authorization

Jeter Cook and Jepsen Architects retained Graef, Anhalt, Schloemer & Associates, Inc. (GAS) to identify and assess the water supply requirements and to recommend a water supply and a wastewater collection and disposal strategy for a proposed Casino Gaming and Regional Entertainment Center (Menominee Casino-Hotel) in Kenosha, Wisconsin.

1.2 Background

The proposed site for the Menominee Casino-Hotel is the existing Dairyland Greyhound Park site, located just east of Interstate 94, between Hwy. 158 and Hwy. K. The proposed site location is shown on **Figure 1-1**. An aerial view if the proposed site is shown in **Figure 1-2.**

The proposed casino will co-exist with the existing Dairyland Greyhound Park. The 1,810,000 square foot gaming resort will include gaming areas for slot machines and table games, restaurants, bars/lounges, entertainment facilities, a hotel, conference facilities, recreations facilities and future development for an additional hotel, water park and RV Park.

1.3 Objectives

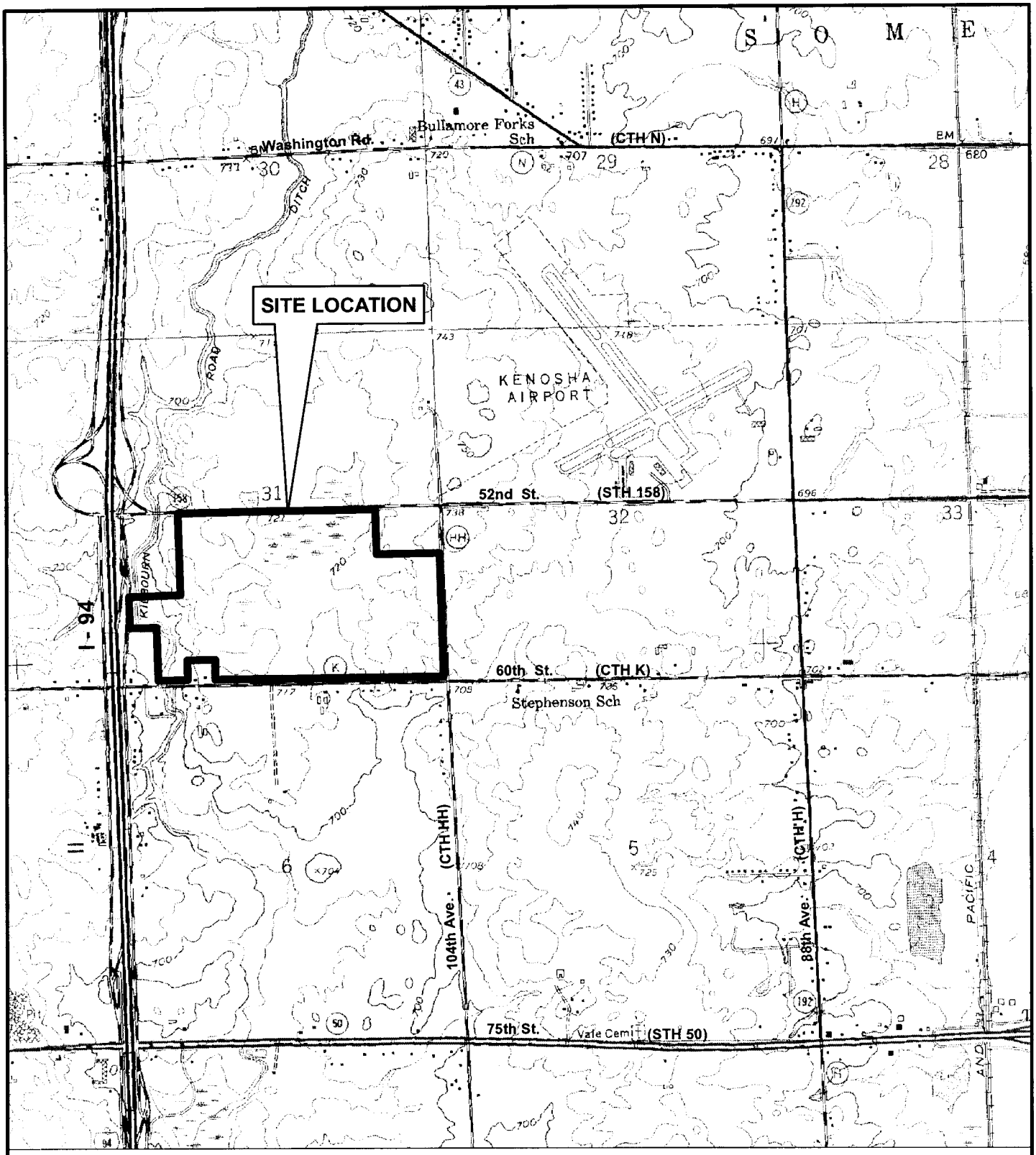
This study assesses and recommends a water supply and a wastewater removal approach for the proposed Menominee Casino-Hotel. Specific objectives include the following:

1. To estimate the water consumption requirements for the proposed facility and develop a strategy to dispose of the wastewater
2. To estimate the water supply and storage requirements for the proposed facility
3. Provide a preliminary evaluation of the regulatory and engineering requirements for the gaming facility's water and wastewater systems.

Section 2 - Water and Wastewater Requirements

2.1 General

The water requirements for the Menominee Casino-Hotel as well as the wastewater produced by the development are presented in this section. The land area for the development is located within the current service area for the City of Kenosha's water distribution system and sanitary sewer system. **Table 2-1** represents a summary of area for the different components of the Menominee Casino-Hotel.



SOURCE: UNITED STATES GEOLOGICAL SURVEY; PLEASANT PRAIRIE QUADRANGLE, KENOSHA CO., WISCONSIN 7.5 MINUTE SERIES; 1971

FIGURE 1.1

SITE LOCATION MAP

MENOMINEE CASINO - HOTEL

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PROJECT MGR:	JTM
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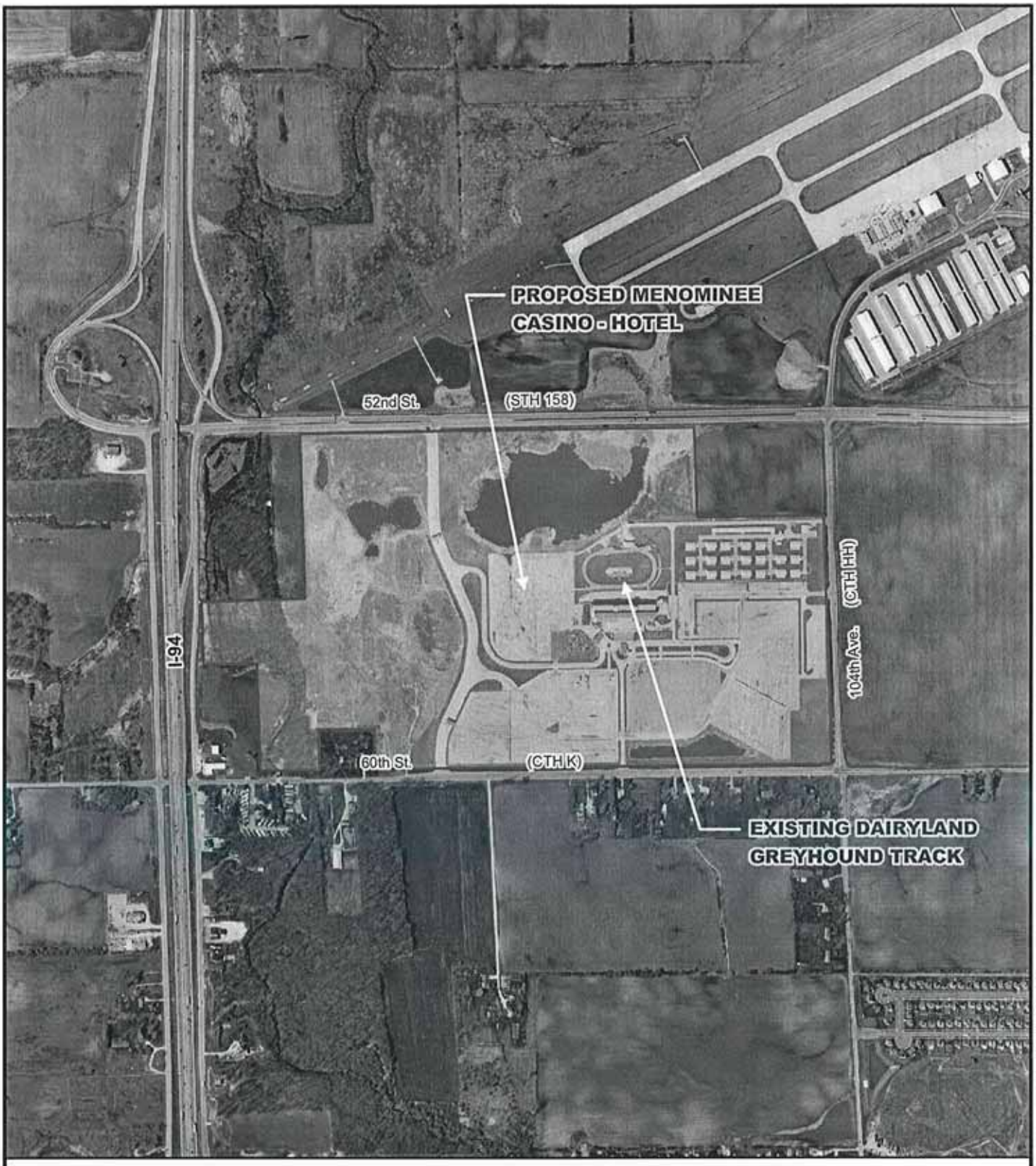

FIGURE 1.2

AERIAL VIEW

MENOMINEE CASINO - HOTEL

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Table 2.1: Menominee Casino-Hotel Facilities

Facilities	Size (ft^2)		
	Phase I	**Phase II**	**Total**
Casino	94,300	15,400	109,700
Race Book	3,800	0	3,800
Casino/Race Book Support	31,300	10,400	41,700
Food and Beverage			0
Restaurants	27,500	0	27,500
Coffee Shop	0	12,600	12,600
Buffet	28,500	0	28,500
Quick Dining	11,800	0	11,800
Employee Dining	9,000	0	9,000
Bars/Lounges	17,800	9,000	26,800
Entertainment	92,100	18,000	110,100
Public Spaces	43,600	0	43,600
Retail	49,400	0	49,400
Administration (local)	28,400	0	28,400
Menominee Tribal Gaming Commission	5,800	0	5,800
Central Administration	85,800	14,000	99,800
Employee Services	34,800	0	34,800
Secure B.O.H.	18,900	0	18,900
Building Support	264,800	29,300	294,100
Total Casino/Amenities Floor Area	**847,600**	**108,700**	**956,300**
Hotel			
Guest Rooms	0	272,400	272,400
Guest Services	0	16,760	16,760
Conference	0	79,942	79,942
Recreation	0	41,600	41,600
Back-of House	0	4,900	4,900
Total Hotel/Amenities Floor Area	**0**	**415,602**	**415,602**
Total Project	**847,600**	**524,302**	**1,371,902**
Future Development			
Water Park			50,000
Hotel			390,000
Total Project with Future Development			**1,811,902**

2.2 Wastewater Flow Projections

Wastewater flows were determined for the Menominee Casino-Hotel based on the capacity of each facility. Once the capacity of each facility was determined (determined by Jeter Cook & Jepsen Architects, Inc.), a flow/unit was assigned based on engineering practice and comparisons to similar facilities. The estimated average wastewater flows for the Menominee Casino-Hotel can be found in **Table 2-2**.

Table 2-2: Estimated Average Wastewater Flows for the Menominee Casino-Hotel

	Quantity			Units	Flow (gallons)/unit	Factor	Flow (gpd)	
	Phase 1	Phase II	Future				Phase I	Total
Casino								
Patrons[1]	8,400	1,374	0	per day	5	100%	42,000	48,870
Employees[2]	2,750	808	0	per day	12	66%	21,780	28,179
Restaurants								
Steakhouse	200	0	0	seats	40	70%	5,600	5,600
Italian/ Seafood	125	0	0	seats	40	70%	3,500	3,500
Asian Cuisine	125	0	0	seats	40	70%	3,500	3,500
Latin American	175	0	0	seats	40	70%	4,900	4,900
Coffee Shop (24-hr.)	0	275	0	seats	60	70%	0	11,550
Buffet	375	0	0	seats	40	70%	10,500	10,500
Quick Serve	200	0	0	seats	40	70%	5,600	5,600
Employee Dining Room	300	0	0	seats	60	70%	12,600	12,600
Lounges								
Entertainment Lounge	316	0	0	seats	20	70%	4,424	4,424
Sports Bar	50	0	0	seats	20	70%	700	700
Restaurant Lounge	50	0	0	seats	20	70%	700	700
VIP Lounge	14	0	0	seats	20	70%	196	196
Night Club	0	340	0	patrons	20	70%	0	4,760
Entertainment								
Multi-Purpose Events Hall	5,760	0	0	per day	5	70%	20,160	20,160
Family Entertainment Center	0	1,200	0	per day	5	70%	0	4,200
Hotel							0	
Suites	0	42	0	rooms	100	70%	0	2,940
Guest Rooms	0	400	0	rooms	100	70%	0	28,000
Conference Facility								
Ballrooms	0	2,000	0	per function	5	70%	0	7,000
Meeting Rooms	0	766	0	persons	10	70%	0	5,362
Recreation Facilities								
Health Club	0	42	0	persons	14	70%	0	412
Spa	0	36	0	persons	14	70%	0	353
Pool	0	260	0	persons	14	70%	0	2,548
Salon	0	114	0	persons	10	70%	0	798
Future Development								
Water Park	0	0	1,300	persons	30	70%	0	27,300
Future Hotel	0	0	500	rooms	100	70%	0	35,000
RV Park	0	0	80	RV's	100	70%	0	5,600
Total flow, gpd							**136,160**	**285,252**

[1] assume 2/3 of the employees will be working on any given day

The proposed wastewater sanitary sewers are sized based on the peak flow. Peak flows assume all of the proposed facilities are operating at full capacity. The estimated peak

wastewater treatment requirement for the Menominee Casino-Hotel can be found in **Table 2-3**.

Table 2-3: Estimated Peak Wastewater Flows for the Menominee Casino-Hotel

	Quantity			Units	Flow (gallons)/unit	Factor	Flow (gpd)	
	Phase 1	Phase II	Future				Phase I	Total
Casino								
Patrons	8,400	1,374	0	per day	5	100%	42,000	48,870
Employees[1]	2,750	808	0	per day	12	66%	21,780	28,179
Restaurants								
Steakhouse	200	0	0	seats	40	100%	8,000	8,000
Italian/ Seafood	125	0	0	seats	40	100%	5,000	5,000
Asian Cuisine	125	0	0	seats	40	100%	5,000	5,000
Latin American	175	0	0	seats	40	100%	7,000	7,000
Coffee Shop (24-hr.)	0	275	0	seats	60	100%	0	16,500
Buffet	375	0	0	seats	40	100%	15,000	15,000
Quick Serve	200	0	0	seats	40	100%	8,000	8,000
Employee Dining Room	300	0	0	seats	60	100%	18,000	18,000
Lounges								
Entertainment Lounge	316	0	0	seats	20	100%	6,320	6,320
Sports Bar	50	0	0	seats	20	100%	1,000	1,000
Restaurant Lounge	50	0	0	seats	20	100%	1,000	1,000
VIP Lounge	14	0	0	seats	20	100%	280	280
Night Club	0	340	0	patrons	20	100%	0	6,800
Entertainment								
Multi-Purpose Events Hall	5,760	0	0	per day	5	100%	28,800	28,800
Family Entertainment Center	0	1,200	0	per day	5	100%	0	6,000
Hotel							0	
Suites	0	42	0	rooms	100	100%	0	4,200
Guest Rooms	0	400	0	rooms	100	100%	0	40,000
Conference Facility								
Ballrooms	0	2,000	0	per function	5	100%	0	10,000
Meeting Rooms	0	766	0	persons	10	100%	0	7,660
Recreation Facilities								
Health Club	0	42	0	persons	14	100%	0	588
Spa	0	36	0	persons	14	100%	0	504
Pool	0	260	0	persons	14	100%	0	3,640
Salon	0	114	0	persons	10	100%	0	1,140
Future Development								
Water Park	0	0	1,300	persons	30	100%	0	39,000
Future Hotel	0	0	500	rooms	100	100%	0	50,000
RV Park	0	0	80	RV's	100	100%	0	8,000
Total flow, gpd							**167,180**	**374,481**

[1] assume 2/3 of the employees will be working on any given day

2.3 Water Demand Projections

The estimated water supply requirements for the Menominee Casino-Hotel is similar to the wastewater flows produced. However, additional flow has to be taken into consideration for irrigation of the proposed site and make-up water used in the mechanical process. After a conversation with Pat Kressin A.S.L.A., a landscape architects at GAS, an irrigation water demand of 1-inch per week was assumed for irrigation. The make-up water requirements for the mechanical system will be a constant demand of approximately 300-gpm. The development's water demands are summarized in **Table 2-4**.

Table 2-4: Estimated Water Demands for the Menominee Casino-Hotel

Water Demands:	Amount, gpd	Amount, gpm
Average Day Demand[1,6]	285,252	594
Peak Day Demand[2,6]	374,481	780
Landscape Irrigation[3,6]	187,000	390
Mechanical System Make-up Demand[4]	432,000	300
Total Peak Day Demands[5]	993,481	1,470
Recommended Minimum Supply Capacity (gpm)		1500
Fire Flow-3,500 gpm for 2 hours (gal)[7]		3500
Recommended Minimum Supply Capacity with fire flow(gpm)		5000

[1] Assumed equivalent to average wastewater flows

[2] Assumed equivalent to peak day wastewater flows

[3] Assumed one-inch per week on 48.2-ac lawn areas

[4] Mechanical make-up demand is a 24-hour process

[5] Peak day demand + landscape irrigation + mechanical system

[6] Assuming an eight-hour day

[7] Typical fire flow

Section 3 - Water and Wastewater Strategies

3.1 Wastewater Disposal

3.1.1 Existing System

A single, private sanitary sewer lift station serves the entire existing Dairyland Greyhound Park. From the water records for October 2002 to October 2003, the existing site has an average day flow of 24,000 gpd (50-gpm[1]). The smaller meters are currently read bi-monthly and the largest, 4-inch meter is read monthly. Therefore, they do not have records for an existing peak day flow (i.e. labor day). However, the average day flow during the peak month, September 2003, was 39,000 gpd (81-gpm[1]). Assuming the peak day flow was twice the average day flow for the peak month, a conservative peak flow for the existing facility of 80,000 gpd can be assumed (167-gpm[1]). The manufactures pump curve indicates that the output of the pumps at the existing lift station

[1] Conservatively assuming an 8-hour demand period.

is 500 GPM. Therefore, the existing pumps are adequately sized for the existing peak flows.

The existing on-site sewage is collected through a series of private, 8-inch gravity sewers flowing into the existing lift station. (See **Figure 3-1** for the existing on-site sanitary sewer system). The sewage leaves the existing lift station through a private, 6-inch force main and discharges into a 10-inch gravity sewer at 52nd Street and 104th Avenue. The ten-inch gravity sewer eventually connects into a 24-inch gravity sewer at 52nd Street and 86th Avenue. The capacity of the 6-inch forcemain is 0.58 MGD (400-gpm). The 10-inch gravity sewer has a capacity of 1.1 MGD (770-gpm) and the 24-inch gravity sewer has a capacity of 8.65 MGD (6000-gpm). See **Appendix A** for capacity calculations.

Besides the Dairyland Park, the 24-inch gravity sewer serves the industrial park located due east of the dog track, as well as some small residential units. Robert Carlson, Director of Engineering for the City of Kenosha, estimates that the 24-inch gravity sewer has approximately 50% remaining capacity, or 3000-gpm. The capacity of the existing 21-inch gravity sewer originating just north of 60th Street on 86th Avenue also has over 50% remaining capacity (2100-gpm of the 4210-gpm capacity).

All sewage eventually is treated at Waste Water Treatment Plant on Lake Michigan. According to Robert Carlson of the City of Kenosha, the City of Kenosha's wastewater treatment plant has capacity for 30 MGD. Currently, the City of Kenosha treats around 26 MGD during average flows. Therefore, they currently have the capacity to treat the proposed sewage from the Menominee Casino-Hotel.

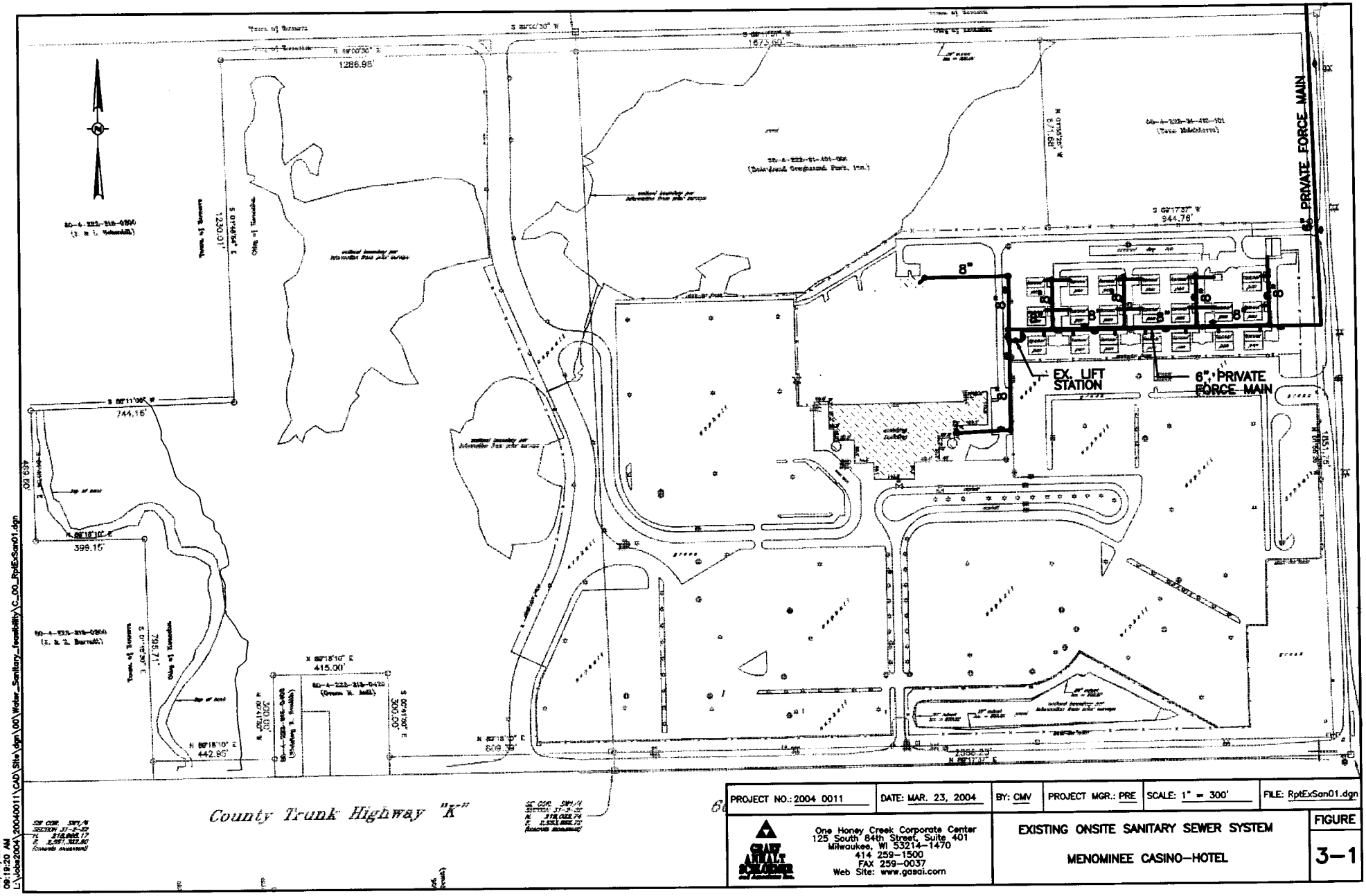
3.1.2 Proposed System

3.1.2.1 On-site

The Menominee Casino-Hotel will require the construction of a new, private lift station (See **Figure 3-2** for the proposed sanitary sewer lift station location). It is our recommendation that the proposed lift station collect the existing on-site sanitary sewage to create a central collection station for the entire property. Also, the condition of the existing lift station is below average and by eliminating it from the system, operation maintenance time will be cut considerably.

The estimated peak flow of the proposed casino is 0.374 MGD or 780-gpm[1]. The proposed lift station must be sized for the existing peak flows and the proposed peak on-site flows. Therefore, the proposed lift station should be sized to handle an estimated peak flow of 947-gpm (780-gpm (proposed) + 167-gpm (existing)).

The sanitary sewer system on the site will be a private system and will flow into the proposed, private sanitary lift station. The existing on-site sewage from the Dairyland Park will be collected at the existing lift station by an 8-inch gravity sewer. The 8-inch sewer will intersect a proposed 8-inch sewer serving the RV Park, which will be constructed as apart of the future development phase, and run west towards the proposed lift station as a 15-inch gravity sewer. Proposed 10-inch gravity sewers will serve the



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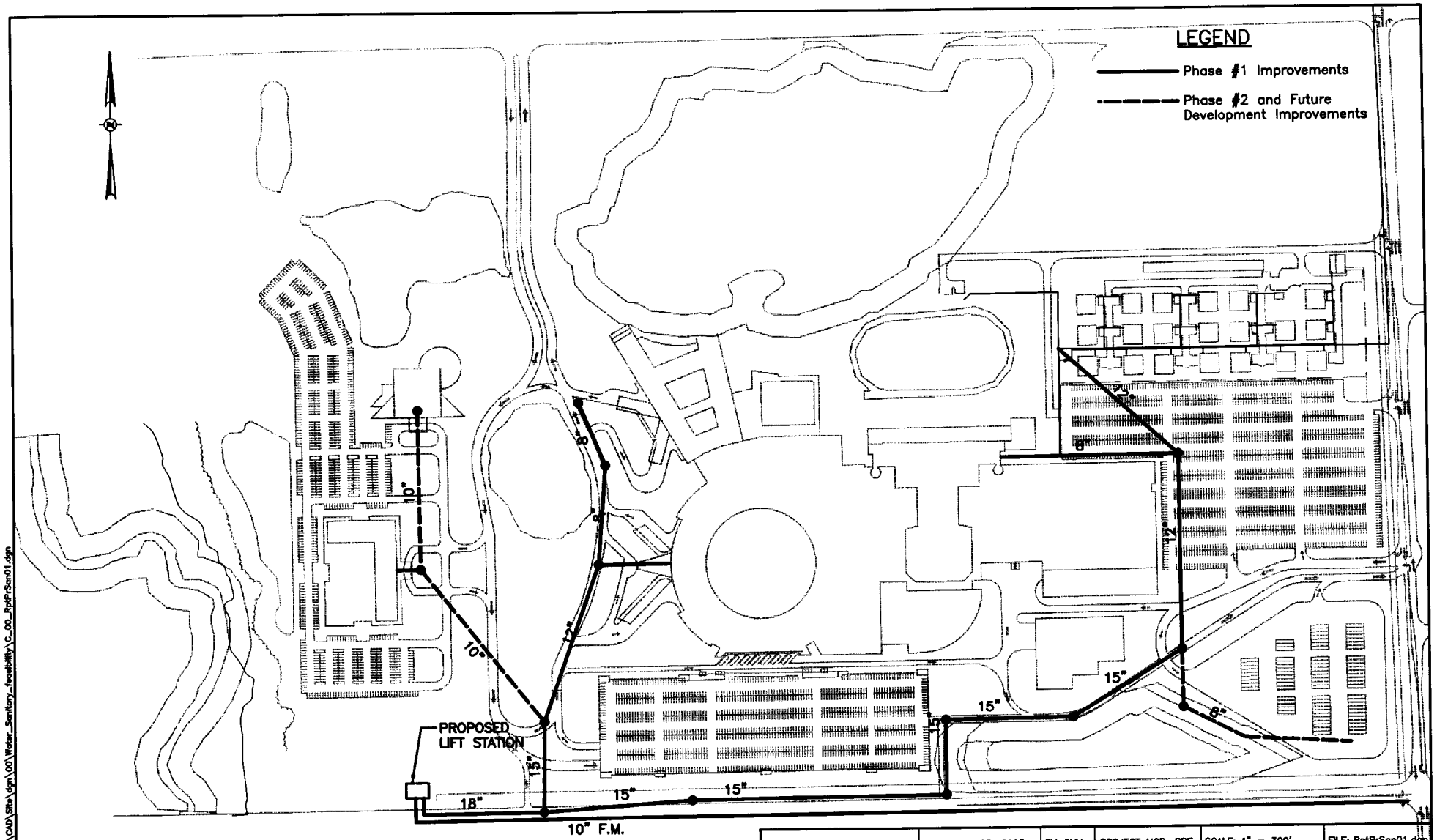
EXISTING ONSITE SANITARY SEWER SYSTEM

MENOMINEE CASINO-HOTEL

FIGURE 3-1



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PROPOSED ONSITE SANITARY SEWER IMPROVEMENTS
MENOMINEE CASINO-HOTEL

FIGURE 3-2

casino, the hotel and water park, which will be constructed as a part of the future development phase. All sewage will eventually enter the proposed lift station through an 18-inch gravity sewer.

The lift station discharge will be a private, 10-inch force main whose reliable capacity at a velocity of 5 ft/s is 1220-gpm. Therefore, the proposed 10-inch force main will handle the estimated future peak flow of 947-gpm. (See **Figure 3-2** for the proposed on-site sanitary sewer system improvements.) The friction headloss of the proposed 10-inch force main at the estimated peak flow will be approximately 85-feet. The static head, or elevation difference, between the force main at the proposed lift station (approximate elevation of 723-feet) and the force main high point (approximate elevation of 725-feet) is 2-feet. Therefore, the total dynamic head the output of the pumps will need to produce at the peak flow is 87-feet. We understand the peak flow will not occur everyday, so the lift station must be flexible to pump smaller flows, yet remain as efficient. GAS recommends installing three identical, variable speed pumps that produce 465-gpm at 87–feet of head. Therefore, during peak flows, two pumps will operate with the third pump on standby. An example is Fairbanks Morse 5400 solids-handling, 20-horsepower, 4-inch pump with a 9.75-impeller. The pump curve can be seen in Appendix B.

The proposed lift station will have an onsite generator and two, 10,000 gallon holding tanks. These holding tanks will provide emergency storage in case of power and generator failure or a control system failure. The holding tanks are sized to provide at least one-hour of storage during peak flow (7000 gallon after Phase #1 and 15,500 gallon at the completion of all phases). One of the 10,000 gallon holding tanks will be built as apart of Phase #1, and the other tank will be built during Phase #2.

3.1.2.2 Off-site

The proposed, private 10-inch force main will leave the proposed lift station, heading east on 60th Street. The force main will continue east, 11,600-feet and empty into the existing 21-inch sewer at an existing manhole on 88th Avenue, just north of 60th Street. As mentioned previously, the existing 21-inch gravity sewer has approximately 50% of its capacity remaining, or 2100-gpm, and currently could handle the proposed peak flow of 947-gpm. The existing 21-inch sewer runs 2100-feet north to a manhole at the intersection of 88th Avenue and 52nd Street. From there, the sewage heads east through an existing 24-inch gravity sewer. As mention previously, the existing 24-inch gravity sewer has approximately 50% of its capacity remaining, or 3000-gpm, providing ample capacity for the proposed peak flow. The existing 24-inch gravity sewer heads east 2650-feet to an existing manhole in the CP Rail System easement, between 88th Avenue and the Union Pacific Railroad. The existing 24-inch gravity sewer continues 4200-feet to an existing lift station at 70th Avenue, north of 51st Street. The lift station discharges into a 1320-feet, 8-inch force main. At 5 ft/s, the reliable capacity of the existing 8-inch force main is 812-gpm. This existing force main does not have the capacity to handle the proposed peak casino flow (770-gpm) and the existing peak Greyhound Park flow (167-gpm), not to mention the other sewage from the service area. Therefore, new pumps as well as a larger force main will have to be installed at the lift station to handle the peak flows from the 24-inch gravity sewer once the casino is operational. (See **Figure 3-3** for

the proposed off-site sanitary sewer system improvements). The reconstruction of the existing lift station is dependent on substantial development in its service area that will necessitate the new pumps and force main at the lift station.

Past this lift station, the City of Kenosha realizes they have inadequacies in their sanitary sewer collection system to handle the peak flows. They already have planned improvements to increase the capacity of their system to handle theses future peak flows.

3.2 Water Supply

3.2.1 Existing System

Using the 2003 water records, the existing site has an average daily flow 24,000-gpd and a peak flow of approximately 167 GPM (see discussion in section 3.1.1). The existing flow is supplied by two, 12-inch water mains, connecting into the City of Kenosha's water distribution system. One of the 12-inch connections is to an existing 16-inch City of Kenosha main on 104th Ave. The other 12-inch connection is to an existing 24-inch main on 60th Street (County Trunk Highway K) (See **Figure 3-4** for the existing on-site water system). All of the existing water mains on site are public, except the water laterals providing service to the existing buildings. All the existing service laterals have flow meters recording the site's water usage.

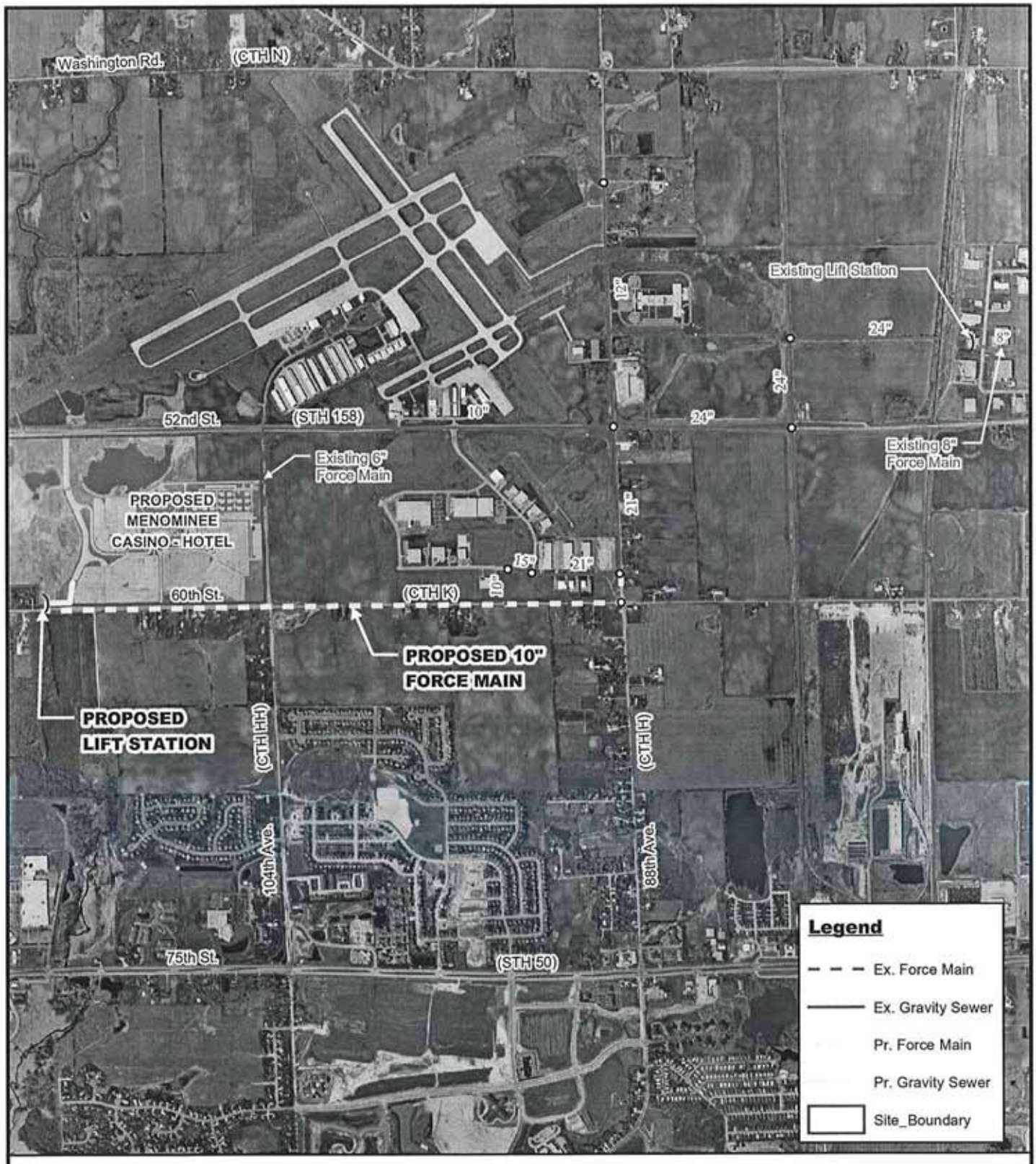
The existing 24-inch water main along 60th Street runs west to the frontage road of Interstate 94 and then south, parallel to Interstate 94. The existing 24-inch main also continues east along 60th Street, from the existing 12-inch, until the intersection of 104th Ave. and 60th Street. The 24-inch main then splits north as a 16-inch main and south as a 24-inch main. There is a 24-inch main at 104th Ave and 60th Street that connects into an existing 24-inch main at 99th Avenue and 56th Place.. The existing 16-inch water main on 104th Ave continues south to aforementioned intersection at 104th Avenue and 60th Street and north to 52nd St. The 16-inch main continues east on 52nd St. (See **Figure 3-6** for the existing off-site water system).

The capacity of the water distribution system has been analyzed using a maximum distribution system velocity of five feet per second. This will allow for a minimal headloss and ensure adequate pressure for fire events. The capacity of the existing twenty-four inch water main, flowing at a velocity of five feet per second is 10 MGD, or 7000-gpm. The capacity of the 16-inch water main flowing at a velocity of five feet per second is 3.2 MGD, or 2200-gpm.

3.2.2 Proposed System

3.2.2.1 On-site

GAS recommends the water system on the proposed site be a private system after the connections to the City of Kenosha's water mains. GAS recommends making an additional 16-inch connection to the City of Kenosha's 24-inch water main in 60th Street at the south entrance drive. There will be additional mains added on-site site to create



PROPOSED OFF-SITE
SANITARY SEWER IMPROVEMENTS

MENOMINEE CASINO - HOTEL

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DATE:	03-23-05
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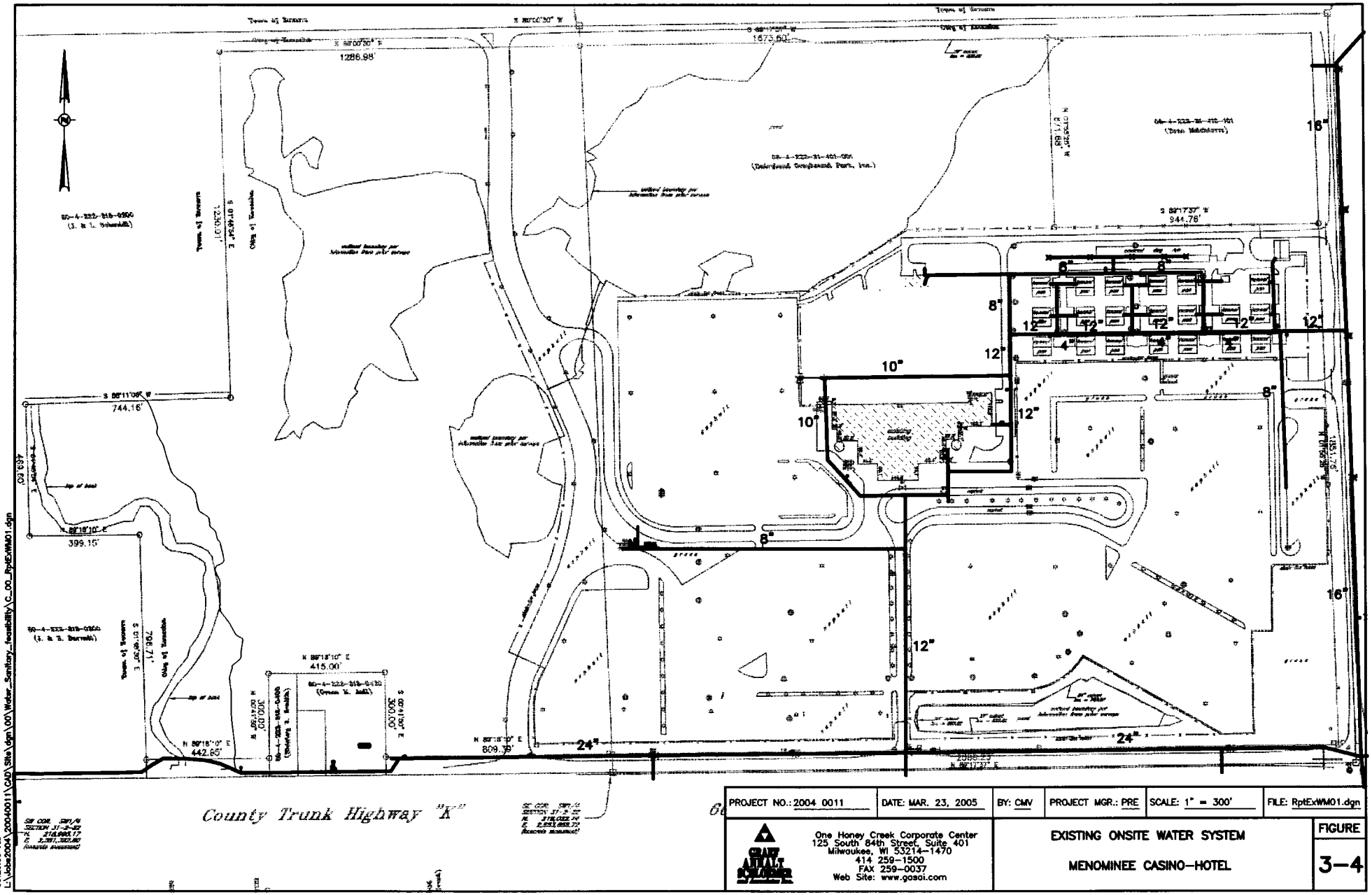
FIGURE 3-3



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EXISTING ONSITE WATER SYSTEM

MENOMINEE CASINO-HOTEL

FIGURE 3-4

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system reliability and ensure adequate pressure and flow. (See **Figure 3-5** for the proposed on-site water system.) With the peak existing demand of 167-gpm and a proposed peak flow of 1500-gpm, the on-site water system needs to be able to serve 1667-gpm during the peak day. With the addition of a fire flow demand of 3500-gpm, the peak flow the on-site water main needs to provide is 5167-gpm. The maximum reliable flow through a 16-inch and 12-inch is 2200-gpm and 1700-gpm respectively. Therefore, the existing 12-inch connections combined with the proposed 16-inch connection will be able to reliably supply the peak demand with a fire flow.

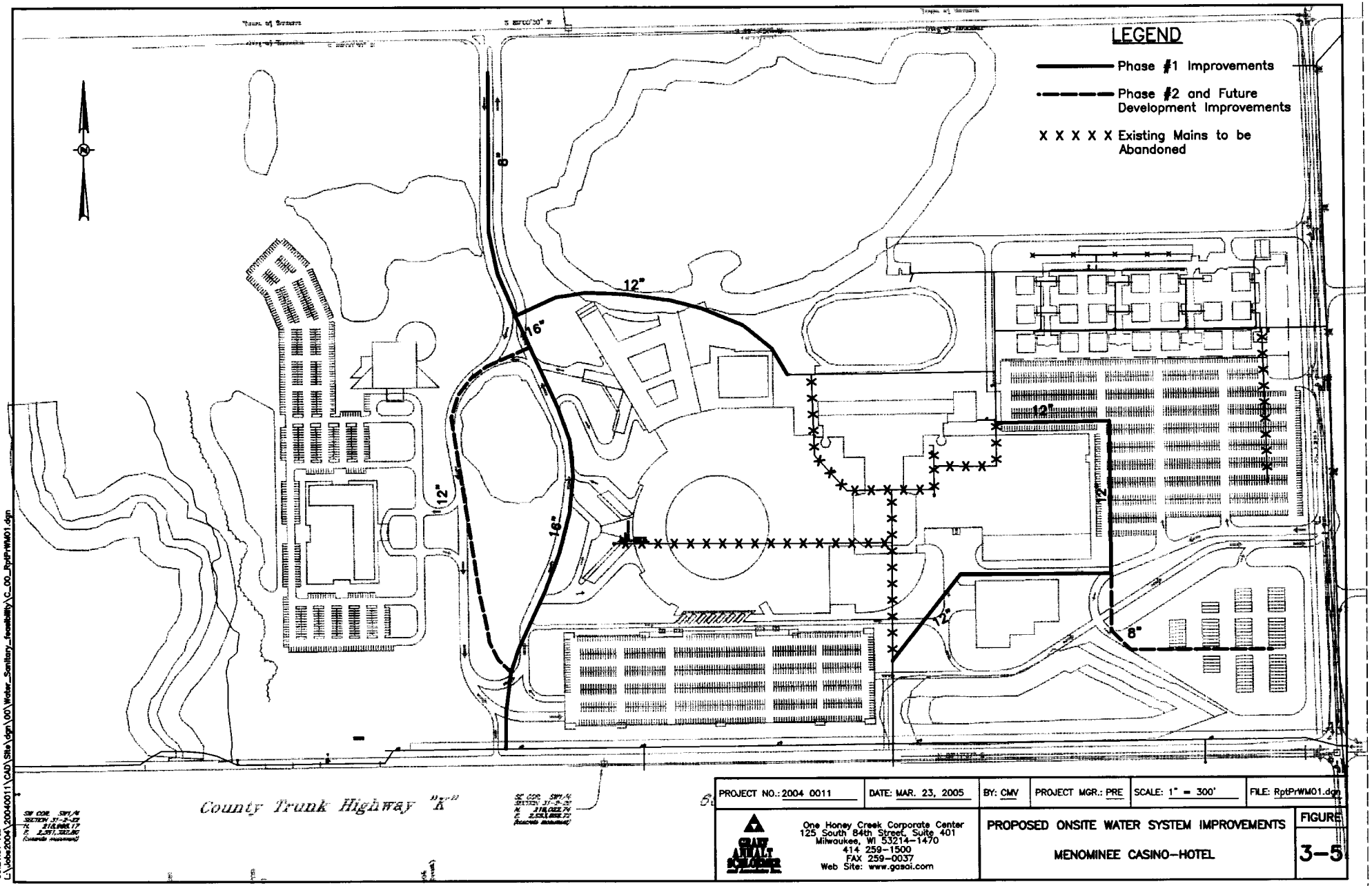
The private water mains onsite are designed to supply the peak flows as well as a fire flow. With the large mains on-site and lack of flow through capabilities because of a private system, water quality during average demand periods could be a concern. However, as demonstrated in the calculations below, water quality in the private, onsite system should remain at a high level because of the large demands from the proposed site. The following is a listing of the total volume of water that will be on-site with the proposed system.

	Total L.F. of Water Main					
	2"	5"	8"	10"	12"	16"
Existing System to Remain	532	830	1207	750	1831	
Proposed System			940		4329	1643
Total Lineal Feet	532	830	2147	750	6160	1643
Volume of water in main, gallons	347	3,385	22,415	12,235	144,700	68,613
Total Volume of Water On-Site, gallons	251,695					

The estimated average day usage of the proposed site is 926,582 gallons (283,852 gallons for the proposed development daily usage, 187,000 gallons for the proposed irrigation daily usage, 432,000 gallons for the proposed mechanical system make-up usage and 24,000 gallons for the existing daily usage). Therefore, the turnover of water on-site, on an average day, will be approximately 0.27 days or 6.5 hours (251,695 gallons) /(922,262gallons/day). With a turnover rate of less than a half-day, fresh water will be present at the proposed site during an average demand period. This calculation does not take into consideration the turnover of water through each dead-end or water service but rather is an overall representation of the turnover through the entire system. We would recommend a flushing program, where the hydrants are flushed approximately twice a year, be implemented on the dead-end sections to ensure proper turnover of water through these sections.

3.2.2.2 Off-Site

The City of Kenosha plans on constructing a 1.0 MG elevated tank west of Interstate 94, between 60th Street and 75th Street, and could be constructed by the end of 2005, according to Robert Carlson. There is an existing 24-inch water main on the west frontage road of Interstate 94, between 60th Street and 75th Street. The City of Kenosha will need to add a proposed 24-inch water main off of the existing 20" Interstate 94 water main crossing to connect to the proposed 1 MG water tower.



PROJECT NO.: 2004 0011	DATE: MAR. 23, 2005	BY: CMV	PROJECT MGR.: PRE	SCALE: 1" = 300'	FILE: RptPrWM01.dgn

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PROPOSED ONSITE WATER SYSTEM IMPROVEMENTS

MENOMINEE CASINO-HOTEL

FIGURE 3-5

03/30/2005
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The City of Kenosha plans on constructing a 4MG at-grade reservoir with a booster station. The proposed site for the booster station and reservoir is located just north of 56th Place and west of 88th Avenue. The construction of the proposed booster station is dependent on substantial development in the area that will necessitate the booster station and reservoir. There already is a 24" water main that is capped at the site. The proposed booster station and reservoir will be ideal service for the Menominee Casino-Hotel. To increase the pressure and flow available to the proposed casino site and to the City of Kenosha's other customers west of 88th Avenue, the City of Kenosha installed a 24-inch main form the existing 24-inch stub at 104th Avenue and 60th Street to an existing 24-inch stub at 99th Avenue and 56th Place. This will allow the water from the proposed booster station to flow to the west, into the system. The City of Kenosha will have to review the water mains supplying water to the proposed booster station. Additional mains may be necessary to supply adequate flow and pressure to the booster station.

The proposed booster station and elevated tower will establish a new pressure zone. This zone will operate at higher pressures than what is currently seen on-site and will provide the Menominee Casino-Hotel with more reliable flows.

See **Figure 3-6** for the proposed off-site water system improvements.

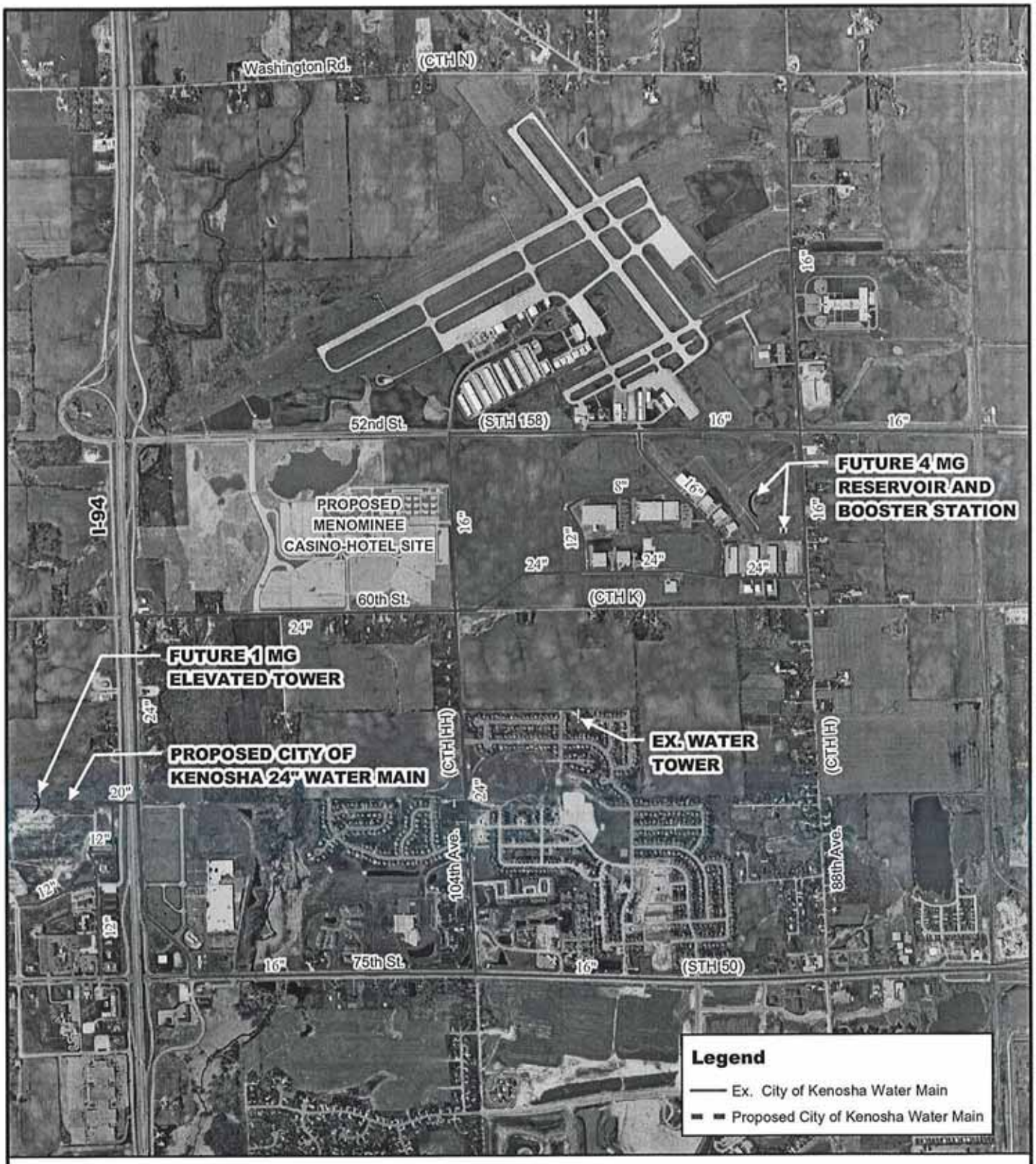


FIGURE 3-6

PROPOSED OFF-SITE
WATER MAIN IMPROVEMENTS

MENOMINEE CASINO-HOTEL

PROJECT NUMBER:	2004 0011
DATE:	03-30-05
PROJECT MGR:	DJK
DRAWN BY:	CMV
FILE NAME:	water3-6.mxd
SCALE:	1"=2000'
REVISED:	

GRAEF ANHALT SCHLOEMER and Associates Inc

File: L:\Jobs2004\20040011\GIS\Maps\Water3-6.mxd

Appendix A

Ex. 24" Gravity Sewer
Worksheet for Circular Channel

Project Description	
Project File	o:\fmw\project1.fm2
Worksheet	mccarthy
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.003500	ft/ft
Diameter	24.00	in

Results		
Depth	2.00	ft
Discharge	6,010	gpm
Flow Area	3.14	ft^2
Wetted Perimeter	6.28	ft
Top Width	0.00	ft
Critical Depth	1.32	ft
Percent Full	100.00	
Critical Slope	0.005897	ft/ft
Velocity	4.26	ft/s
Velocity Head	0.28	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	6,460	gpm
Full Flow Capacity	6,010	gpm
Full Flow Slope	0.003500	ft/ft

Ex. 21" Gravity Sewer
Worksheet for Circular Channel

Project Description	
Project File	I:\jobs2004\20040011\project_information\calcs\capacity.fm2
Worksheet	mccarthy
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.003500	ft/ft
Diameter	21.00	in

Results		
Depth	1.75	ft
Discharge	4,210	gpm
Flow Area	2.41	ft^2
Wetted Perimeter	5.50	ft
Top Width	0.00	ft
Critical Depth	1.14	ft
Percent Full	100.00	
Critical Slope	0.006092	ft/ft
Velocity	3.90	ft/s
Velocity Head	0.24	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	4,530	gpm
Full Flow Capacity	4,210	gpm
Full Flow Slope	0.003500	ft/ft

Ex. 8" Force Main at Reliable Capacity
Worksheet for Pressure Pipe

Project Description	
Project File	I:\jobs2004\20040011\project_information\calcs\capacity.fm2
Worksheet	dsfg
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Input Data	
Pressure at 1	28.00 psi
Pressure at 2	0.00 psi
Elevation at 1	671.00 ft
Elevation at 2	715.00 ft
Length	1,320.00 ft
C Coefficient	115.0
Diameter	8.00 in

Results		
Discharge	812.0	gal/min
Headloss	20.58	ft
Energy Grade at 1	736.43	ft
Energy Grade at 2	715.84	ft
Hydraulic Grade at 1	735.58	ft
Hydraulic Grade at 2	715.00	ft
Flow Area	0.35	ft^2
Wetted Perimeter	2.09	ft
Velocity	5.18	ft/s
Velocity Head	0.42	ft
Friction Slope	0.015594	ft/ft

Prop. 10" Force Main at Peak Flow
Worksheet for Pressure Pipe

Project Description	
Project File	I:\jobs2004\20040011\project_information\calcs\capacity.fm2
Worksheet	dsfg
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Input Data	
Pressure at 1	42.50 psi
Pressure at 2	0.00 psi
Elevation at 1	671.00 ft
Elevation at 2	725.00 ft
Length	5,800.00 ft
C Coefficient	115.0
Diameter	10.00 in

Results		
Discharge	989.9	gal/min
Headloss	44.03	ft
Energy Grade at 1	769.29	ft
Energy Grade at 2	725.26	ft
Hydraulic Grade at 1	769.03	ft
Hydraulic Grade at 2	725.00	ft
Flow Area	0.55	ft^2
Wetted Perimeter	2.62	ft
Velocity	4.04	ft/s
Velocity Head	0.25	ft
Friction Slope	0.007591	ft/ft

Appendix B

4"

5412
VERTICAL FOR FLEXIBLE SHAFTING

5422
HORIZONTAL

5432
VERTICAL BILTOGETHER

5432M&W
SUBMERSIBLE

5442
VERTICAL CLOSE COUPLED

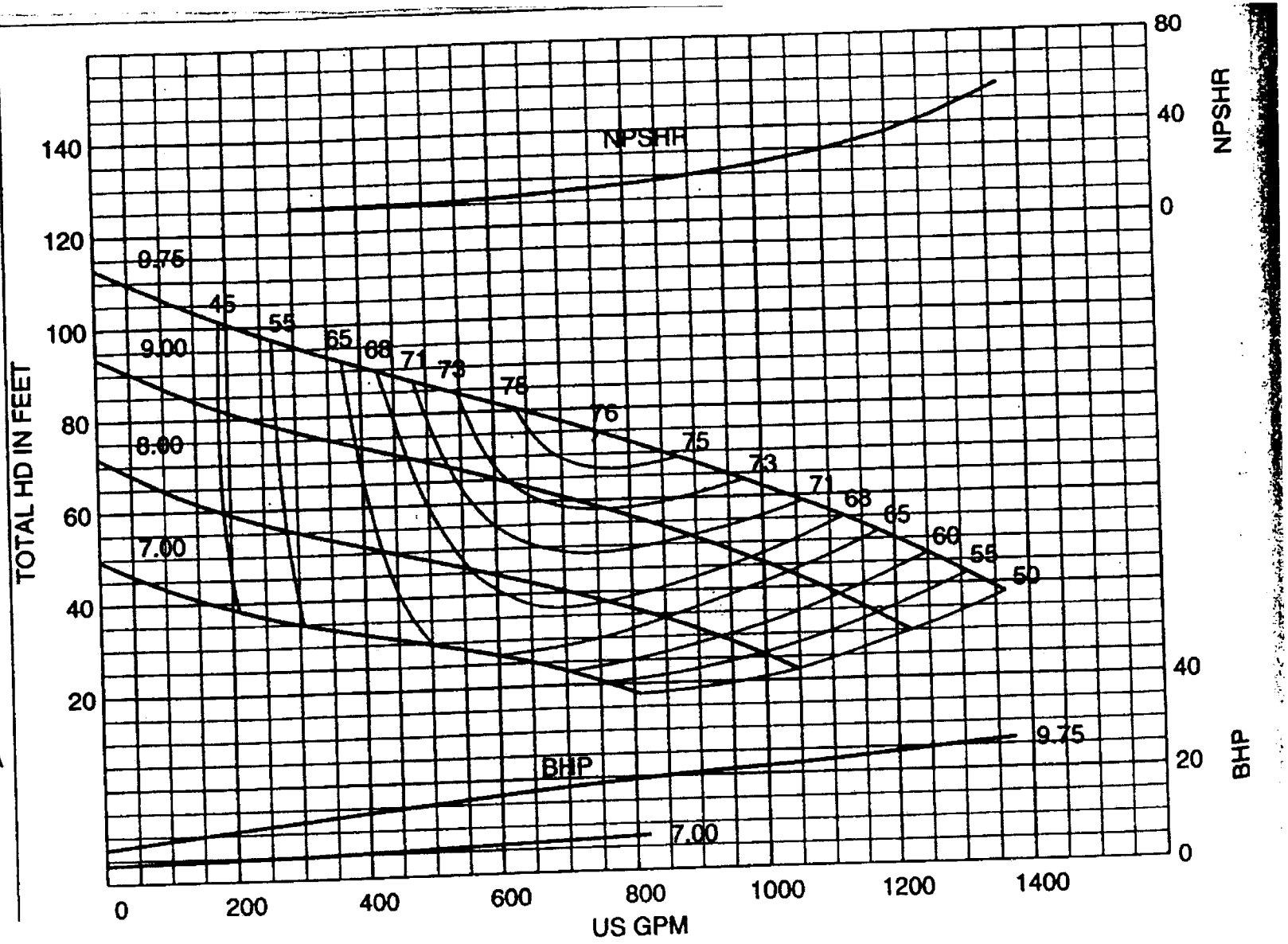
1765 RPM
NO. OF VANES 2

SUCTION SIZE
5422:4"
OTHER: 4" OR 6"

IMPELLER T4B1A

INLET AREA
26.22 SQ.IN.

MAX.SPHERE 3"



1/1/92

Fairbanks Morse Pump Corporation